

## CLAIMS

### What Is Claimed Is:

SUB A1

1. A heating device for use in an internal combustion engine comprising:  
a frame including connecting means for attaching said frame to an engine and  
a recessed body portion having an aperture;  
an electric heating element coupled to said frame;  
5 a terminal assembly connected to said heating element for conducting an  
electric current thereto, said terminal assembly passing through said aperture in said  
recessed body portion; and  
grounding means electrically connected to said heating element.

2. The heating device of Claim 1 wherein said terminal assembly includes  
a first portion connected to said heating element and a second portion removably  
engaged with said first portion, said second portion passing through an opening in  
the engine and engaging the first portion of the terminal assembly.

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3. The heating device of Claim 2 wherein said heating element has a first  
end and a second end, wherein said first portion of said terminal assembly is  
electrically connected to said first end of said heating element and wherein said  
second end of said heating element is electrically connected to said grounding  
5 means.

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3/4. The heating device of Claim <sup>2</sup>3 wherein said first portion of said terminal assembly includes a bolt and a union nut cooperating to connect said first end of said heating element to said frame, a plurality of insulators arranged to electrically isolate said bolt from said frame, and wherein said second portion of said terminal assembly  
5 includes a double ended stud connected to said union nut and a power source.

4/5. The heating device of Claim <sup>3</sup>4 wherein said grounding means includes a grounding strap coupled to said frame by a threaded bolt.

5/6. The heating device of Claim 1 wherein said recessed body portion of said frame includes side walls having an upper edge and a lower portion, and wherein said connecting means includes a perimeter mounting member extending substantially perpendicular <sup>4</sup>from said upper edge of said side walls.

6/7. The heating device of Claim <sup>5</sup>5 wherein said connecting means further includes a plurality of mounting bolts and wherein said perimeter mounting member includes a plurality of passages sized to cooperatively engage said mounting bolts whereby said frame is attached to the cylinder head of an internal combustion engine.

7/8. The heating device of Claim <sup>6</sup>6 wherein said recessed body portion includes hubs projecting from said side walls to form a C-channel and wherein said heating device further includes a C-shaped mounting element disposed within said C-channel, said C-shaped mounting element having insulating members associated  
5 therewith and said insulating members connected to said heating element.

8/9. The heating device of claim 1 further including a second heating element and coupling means for connecting said heating elements in series.

9/10. The heating device of claim 1 further including a second heating element and coupling means for connecting said heating elements in parallel.

10/11. A heating device for use in an internal combustion engine comprising:  
a parallelepiped shaped frame including side walls having an upper edge and a lower portion, at least one of said side walls having an aperture formed therein and a flange connected to an upper edge of the side walls and extending perpendicular<sup>ly</sup> therefrom;

a heating element connected to said frame;

a terminal assembly including a first portion connected to a first end of the heating element and a second portion removably engageable with said first portion whereby said heating device may be placed into recessed engagement with a cylinder head and whereby said second portion connects a battery to said first portion through an opening formed in the cylinder head; and

grounding means electrically connected to said second end of said heating element.

11/12. The heating device of Claim 11<sup>10</sup> wherein said first portion of said terminal assembly is disposed within an area bounded by said side walls.

<sup>12</sup>  
~~13~~. The heating device of Claim <sup>11</sup>~~12~~ wherein said frame includes at least one transverse support member connecting said side walls and a vertical support member projecting perpendicular<sup>14</sup> from at least one of said at least one transverse support members and wherein said first portion of said terminal assembly includes a bolt sized to cooperatively engage an opening formed in said vertical support member and threaded to removably engage a first end of a union nut, a plurality of insulators arranged to electrically isolate said bolt from said vertical support member.

<sup>13</sup>  
~~14~~. The heating device of Claim <sup>12</sup>~~13~~ wherein said second portion of said terminal assembly includes a double ended stud having a first end coupled to a second end of said union nut and a second end connected to a power source whereby an electric current is conveyed to said heating element.

<sup>14</sup>  
~~15~~. The heating device of Claim <sup>13</sup>~~14~~ wherein said grounding means includes a first bolt having a head and a threaded body adapted to cooperate with a threaded passage formed in said at least one transverse support member to connect said second end of said heating element to said at least one transverse support member and a ground strap coupled to said frame by a second threaded bolt.

<sup>15</sup>  
~~16~~. The heating device of claim <sup>10</sup>~~11~~ further including a second heating element and coupling means for connecting said heating elements in series.

<sup>16</sup>  
~~17~~. The heating device of claim <sup>10</sup>~~11~~ further including a second heating element and coupling means for connecting said heating elements in parallel.

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18. A system for heating the airflow entering the cylinder head of an internal combustion engine, said system comprising:

a cylinder head having a threaded bore and an intake opening;

a heating device including a frame removably engaging said intake opening,  
5 an electric heating element coupled to said frame, a terminal assembly connected to said heating element and a power source, said frame including a perimeter mounting member having an upper surface and a lower surface and a recessed body portion having an aperture formed therein, said lower surface of said perimeter mounting member supported by said cylinder head, said recessed body portion extending  
10 substantially perpendicular<sup>ly</sup> from said perimeter mounting member and into said intake opening, said terminal assembly having a first portion connected to said heating element and a second portion removably engaged with said first portion and extending through said aperture in said recessed body portion and through said threaded bore in said cylinder head;

15 a cover plate having an inlet means for receiving airflow, said cover plate supported by said upper surface of said perimeter mounting plate;

a first gasket disposed between said upper surface of said perimeter mounting member and said cover plate;

a second gasket disposed between said lower surface of said perimeter  
20 mounting member and said cylinder head;

securing means for coupling said cover plate, said first gasket, said heating device and said second gasket to said cylinder head; and

grounding means electrically connected to said heating element.

<sup>18</sup>  
~~19~~. The heating system of Claim <sup>17</sup>~~18~~ wherein said grounding means includes a tab projection formed integrally with said perimeter mounting member, said tab projection having a threaded orifice formed therein, a grounding strap having a first end and a second end, a grounding bolt sized to engage said orifice and said first  
5 end of said ground strap, said second end of said grounding strap electrically connected to an engine element having ground potential.

<sup>19</sup>  
~~20~~. The heating system of Claim <sup>17</sup>~~18~~ wherein said securing means include a plurality of apertures formed in said gaskets, cover plate and perimeter mounting member, a plurality of threaded blind bores formed in said cylinder head and a plurality of threaded bolts sized to cooperatively engage said apertures and threadably  
5 engage said blind bores.

<sup>20</sup>  
~~21~~. The heating system of Claim <sup>17</sup>~~18~~ wherein said first portion of said terminal assembly includes a bolt cooperating with an orifice formed in said frame whereby said heating element is coupled to said frame, a plurality of insulators arranged to electrically isolate said bolt from said frame, said bolt removably engaging  
5 a first end of an internally threaded union nut and wherein said second portion of said terminal assembly includes a double ended stud having a first end threadably engaging a second end of said union nut and a second end connected to a power source whereby an electric current passes from said power source to said heating element.

<sup>21</sup>  
~~22~~. The heating device of claim <sup>17</sup>~~18~~ further including a second heating element and coupling means for connecting said heating elements in series.

*24* 23. The heating device of claim *17* further including a second heating element and coupling means for connecting said heating elements in parallel.

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A method of heating air entering a cylinder head of an internal combustion engine comprising the steps of:

forming an intake opening and a bore in a cylinder head, said intake opening having a perimeter;

5 placing a first gasket on said cylinder head adjacent to the perimeter of said intake opening;

placing a heating device within said intake opening, said heating device including a frame and an electric heating element coupled thereto, said frame comprised of a perimeter mounting member having an upper surface and lower  
10 surface and a recessed body portion extending perpendicular from said perimeter mounting member, an aperture formed in said recessed body portion, said intake opening sized to accommodate said recessed body portion and to cooperate with said lower surface of said perimeter mounting member whereby said frame is supported by said cylinder head;

15 connecting a power source to said heating element by passing a portion of a terminal assembly through said bore in the cylinder head and the aperture formed in said recessed body of said frame;

placing a second gasket on said upper surface of said perimeter mounting member;

20 placing a cover plate having inlet means for receiving airflow on said second gasket;

securing said cover, said first and second gaskets and said heating device to said cylinder head;

connecting an intake hose to said inlet means; and

25 grounding said electric heating element.